

Introduction

Mitochondria and Neuroprotection—In Memory of Albert L. Lehninger

Gary Fiskum¹

This issue represents the proceedings of the Mitochondria and Neuroprotection Symposium held in Fort Lauderdale Florida on April 16–19, 2004. In addition to the minireviews authored by plenary session speakers, four research communications are included representing results presented at the poster sessions. Over 130 scientists from many different countries attended the symposium and 40 posters were presented. The symposium was held in memory of Dr Albert Lester Lehninger, one of the most highly regarded biochemists and medical educators of the twentieth century, whose contributions to the field of mitochondrial bioenergetics form the foundation of much of the research discussed in this special issue.

Albert Lehninger was born in Bridgeport, Connecticut, on February 17, 1917, and received a BA in English from Wesleyan University in 1939. He received his PhD in physiological chemistry from the University of Wisconsin in 1942. Lehninger stayed on at the University of Wisconsin as an Instructor until 1945, when he was appointed Assistant Professor of biochemistry and surgery at the University of Chicago. At this juncture he had published 11 research articles. From 1945 to 1952, he published an additional 33 articles. These studies included the discovery that fatty acid oxidation, ketone body metabolism, and the TCA cycle occur in the mitochondrion, some of the first investigations employing isolation of this organelle (see e.g., JBC 1949 and 1950). Thus, while Lehninger was a chemist at heart, he was one of the founding fathers of cell biology. In 1952 at the tender age of 33, Albert Lehninger was appointed the Chair of Physiological Chemistry at the Johns Hopkins University School of Medicine and retained that position until 1978. He developed this department into what was and still is one of the most outstanding departments of biochemistry in the world. In



Albert L. Lehninger 1917–1986.

the 10 year span of 1952–1962, he published 88 articles. These studies helped elucidate the roles of different electron transport chain complexes in energy metabolism and identified the mitochondrion as a site of action of thyroid hormone. Moreover, his research established many principles of metabolic regulation that apply to all aspects of cellular homeostasis. In the next 10 years, he published 100 articles. This era included elucidation of how mitochondrial calcium uptake was coupled to respiration. He and his coworkers also contributed to the understanding of respiratory uncoupling and mitochondrial transport of ATP and ADP during this period. In 1970, he published an article on “Comparative studies on mitochondria isolated from neuron-enriched and glia-enriched fractions of the brain,” a topic that is still very timely and closely related to the subject of this

¹Department of Anesthesiology, University of Maryland School of Medicine, 685 W. Baltimore St., MSTF 5.34, Baltimore, Maryland 21156; e-mail: gfishk001@umaryland.edu.

symposium. During the next several years, the Lehninger lab expanded on the comparative biology theme, characterizing mitochondrial heterogeneity among different normal tissues, and between normal and neoplastic cells. The 1970s was a period of intense controversy concerning the mechanism of oxidative phosphorylation. While Lehninger's research strongly supported Peter Mitchell's chemiosmotic coupling hypothesis, his meticulous measurements of the stoichiometric relationships between oxygen consumption, proton efflux, and calcium and phosphate uptake helped refine the hypothesis into a generally accepted mechanism. The last approximately 10 years of his career focused on the roles of mitochondrial enzymes and transporters in physiological and pathological energy metabolism and cell calcium homeostasis. These investigations included a comparison of the calcium uptake affinities

of mitochondria and endoplasmic reticulum, and how mitochondrial respiration is inhibited by a factor released by macrophages, later identified as nitric oxide. In total, Lehninger published 310 research articles. In addition, he was the sole author of seven books, including "The Mitochondrion" in 1964, the first edition of "Bioenergetics" in 1965, and three editions of his world-famous Biochemistry textbook, published in over 12 different languages. His numerous additional honors and activities include six honorary doctorates, election to the National Academy of Sciences, and election as President of the American Society of Biological Chemists. Al Lehninger passed away on March 6, 1986. In addition to all his academic accomplishments, he trained scores of scientists and educators from every corner of the globe, and was admired and loved by all who had the good fortune to know him.